

The First Year of VERA Geodetic Experiments

Takaaki Jike ¹, Yoshiaki Tamura ², Seiji Manabe ², NAOJ VERA Group ¹

¹) VERA Observatory, National Astronomical Observatory of Japan

²) Mizusawa Observatory, National Astronomical Observatory of Japan

Contact author: Takaaki Jike, e-mail: jike@miz.nao.ac.jp

Extended Abstract

VERA (VLBI Exploration of Radio Astrometry) aims at the revelation of the structure and dynamics of our galaxy by measuring 3-D positions and motions of galactic compact radio objects with 10 micro-arc-seconds level accuracy. To achieve such highly accurate measurements, geodetic VLBI observations are crucial for the VERA project.

Four antennas, Mizusawa, Iriki, Ogasawara and Ishigaki, constitute the VERA network on the Japanese islands. The longest baseline is Mizusawa-Ishigaki (about 2270km) and the shortest baseline is Iriki-Ishigaki (about 1016km). Monitoring of these baseline-vectors and their stability with 1-2mm accuracy is the main purpose of the VERA geodetic VLBI observations.

For this objective, we hold VERA internal geodetic VLBI experiments on a semi-regular basis. Also, besides these experiments, VERA participates in the Japanese Dynamic Earth Observation (JADE) by GSI for connecting the VERA network to the international VLBI network and carries out continuous GPS observations at the VERA sites for interpolating geodetic VLBI solutions and for confirming rapid variations.

The semi-regular VERA internal geodetic VLBI experiments started in November 2004, and are continued twice a month in 2006, excluding periods of antenna maintenance. The experiments in the graph of Figure 1 have been analyzed by December 2005. The special notes of this experiment are regular use of high-speed sampler, digital filter unit and 1-Gbit recording system, adopting of the Mitaka FX Correlator for correlation processing, and geodetic analysis by CALC3/MSOLV software package.

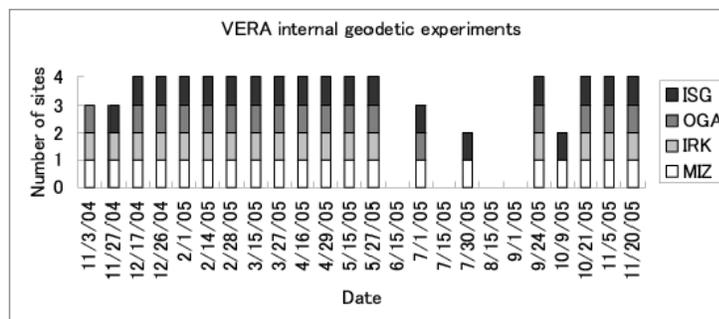


Figure 1. Result of VERA internal geodetic VLBI experiments.

We obtained long-term averaged coordinates and rates of VERA antenna reference points from the solutions of 20 experiments with about 2mm and 0.4mm/y errors. A typical error ellipsoid

obtained from 1 experiment is shown in Figure 2. The size of the ellipsoid is about $\pm 2\text{mm}$ in the East-West and North-South directions, and about $\pm 7\text{mm}$ in the vertical direction.

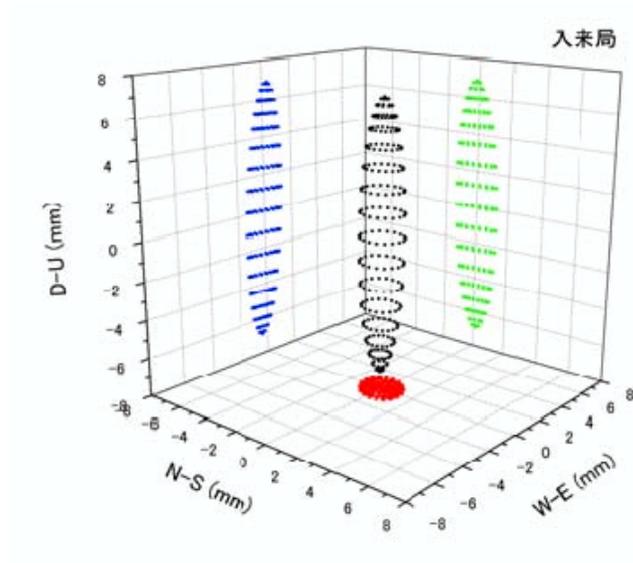


Figure 2. Typical error ellipsoid obtained from geodetic analysis of 1 experiment.

Baseline lengths of the VERA network as measured by VLBI and GPS are compared. We detected similar changes in most of the VLBI and GPS results. Motions of some baselines have a non-linear signature like the seasonal variation shown in Figure 3. It is a future task to reveal the reason of these variations. Differences of baseline length between VLBI and GPS are about 2cm in maximum. It might be due to insufficient accuracy of local tie vector between VLBI and GPS points.

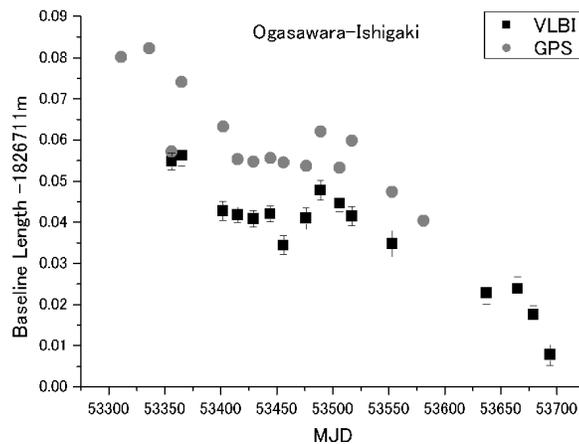


Figure 3. Time variations of Ogasawara-Ishigaki baseline length.